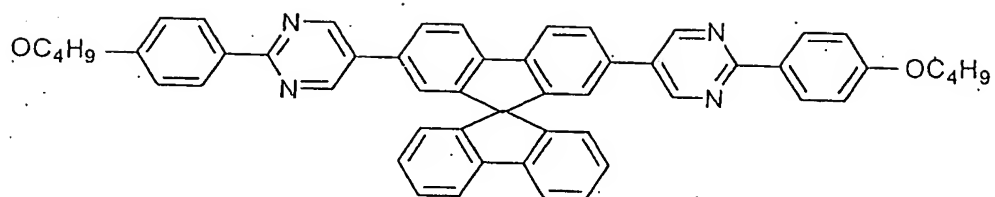


FIG. 1



F-1

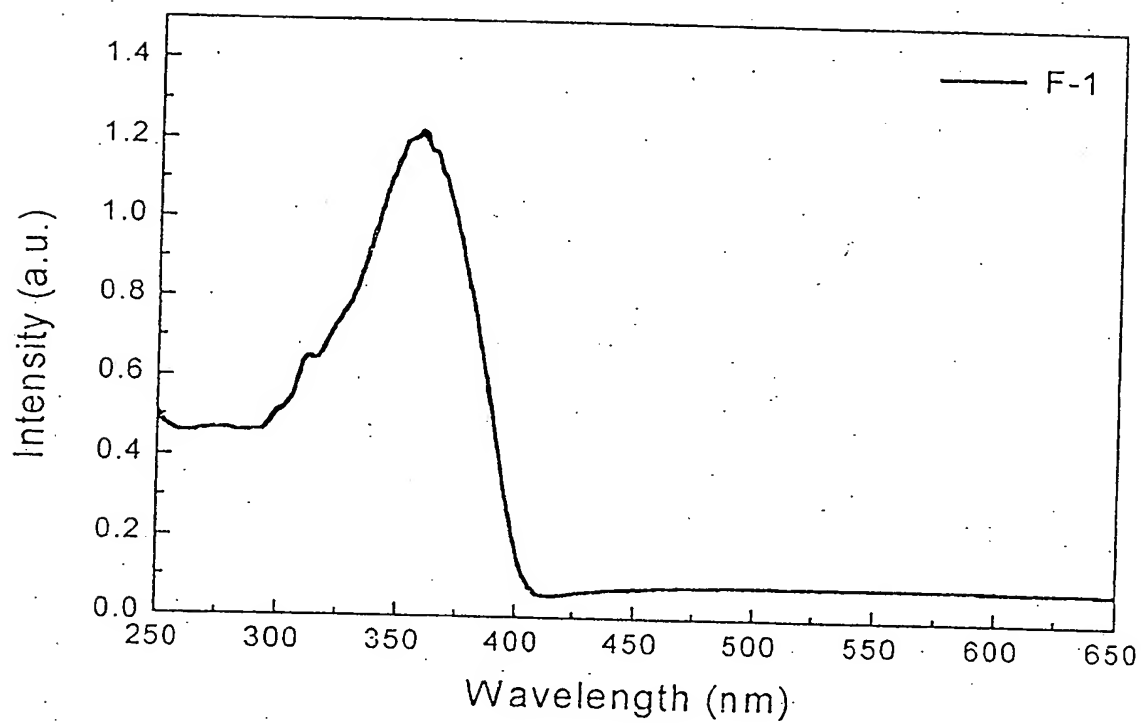
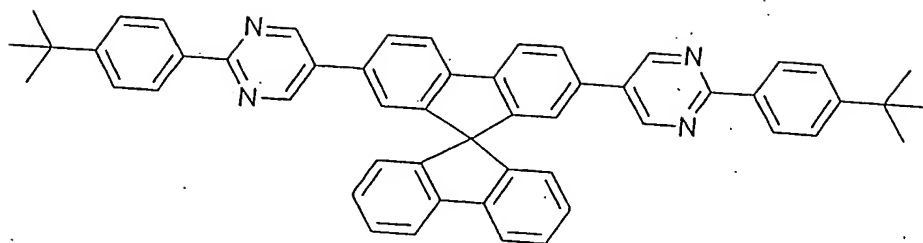


FIG. 2



F-2

2,7-bis[2-(4-tert-butylphenyl)pyrimidine-5-yl]-9,9'-spirobifluorene

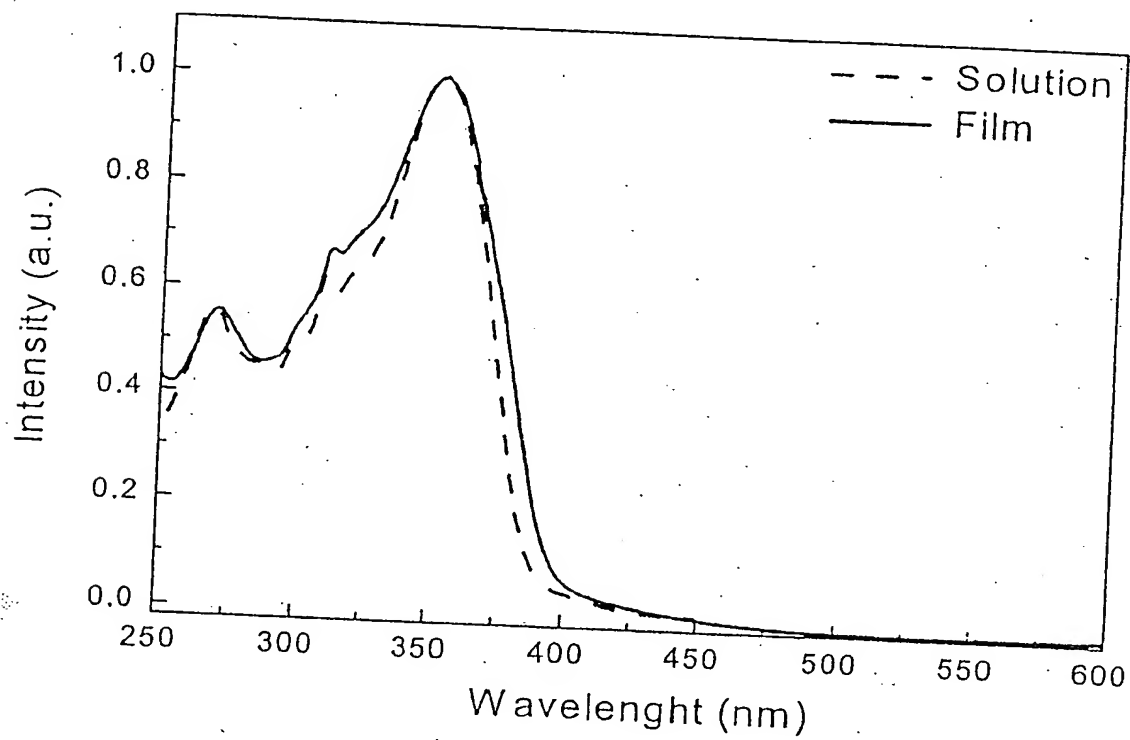
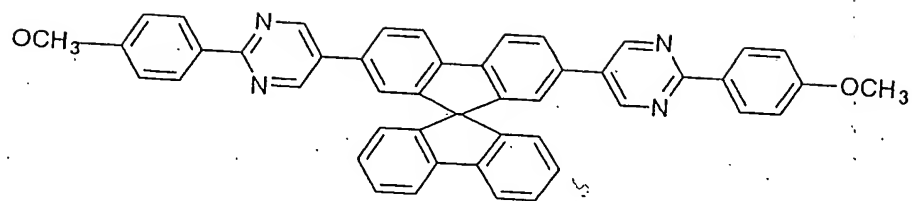


FIG. 3



F-3

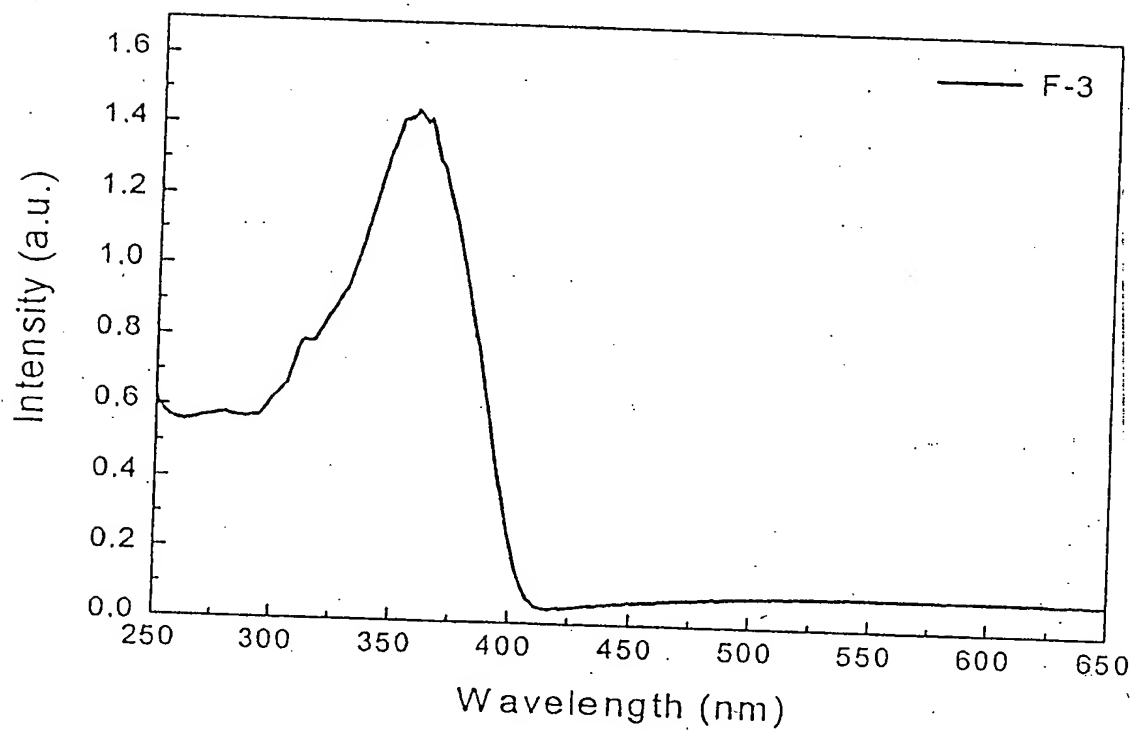
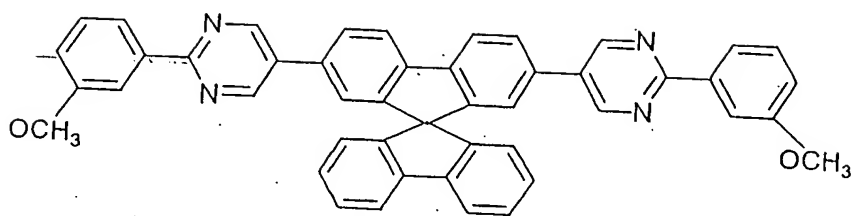


FIG. 4



F-4

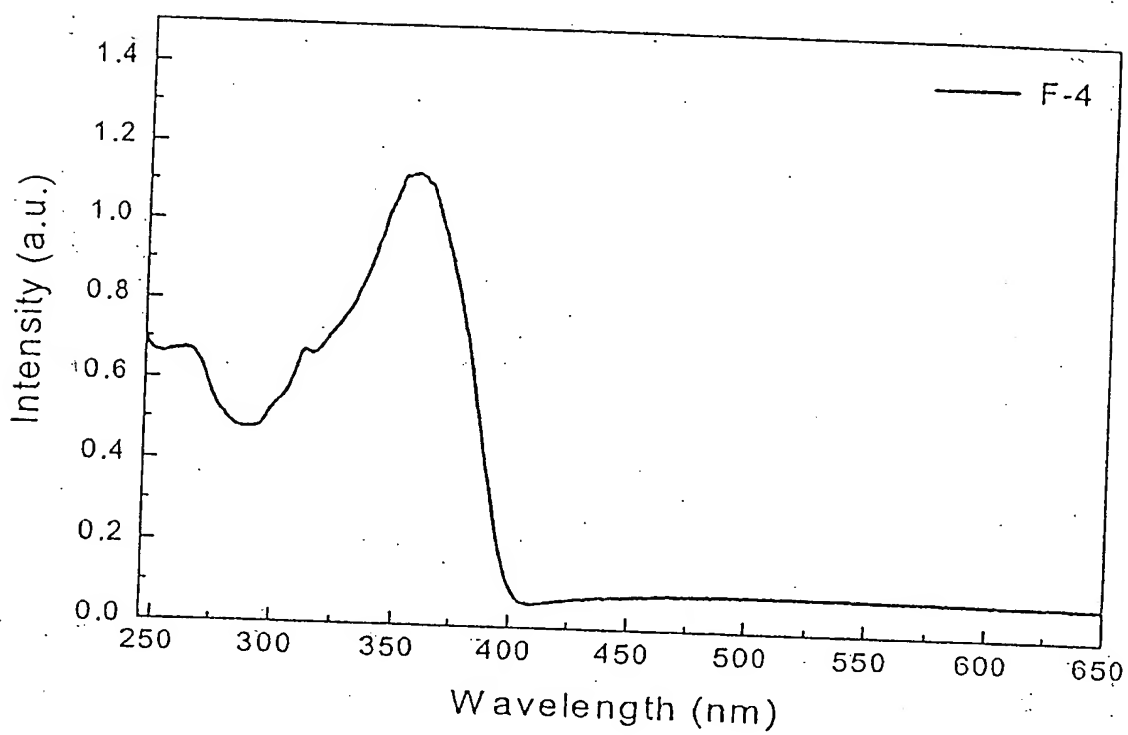


FIG. 5

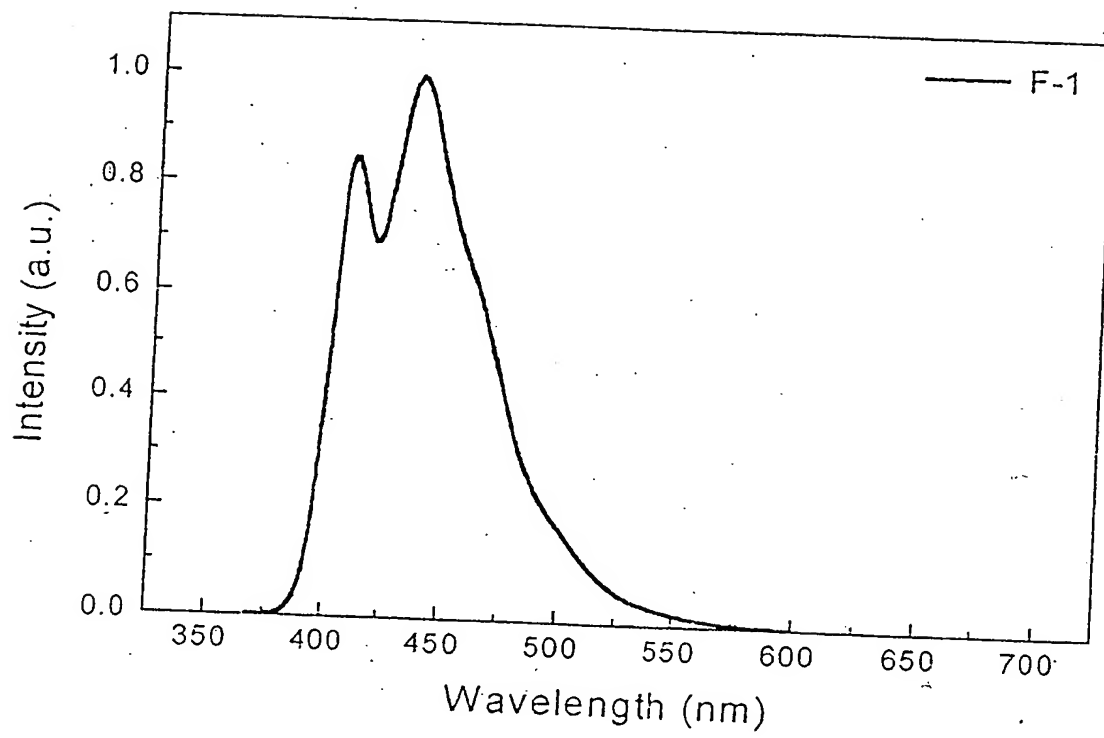


FIG. 6

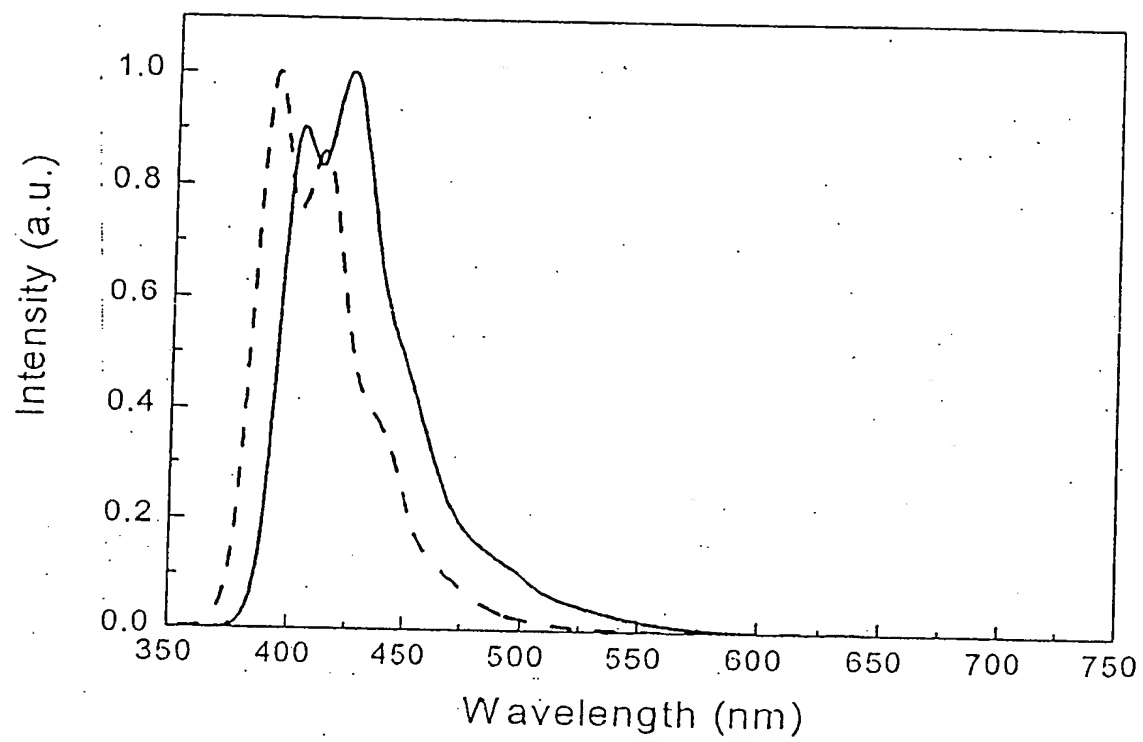


FIG. 7

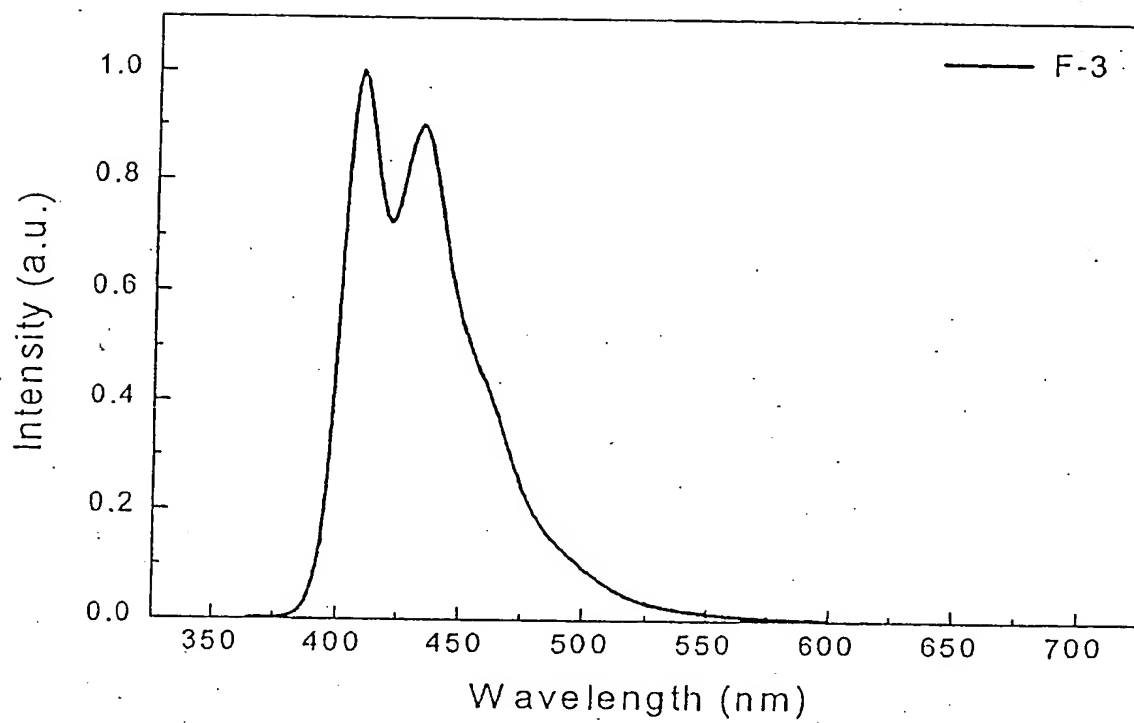


FIG. 8

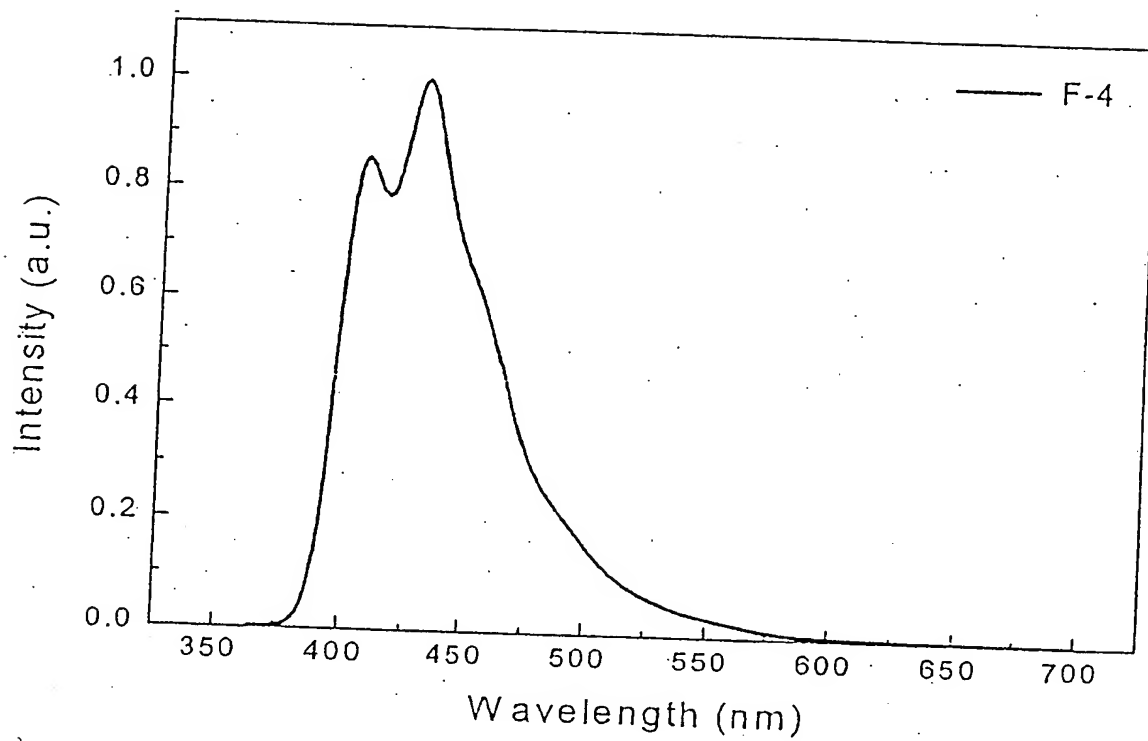
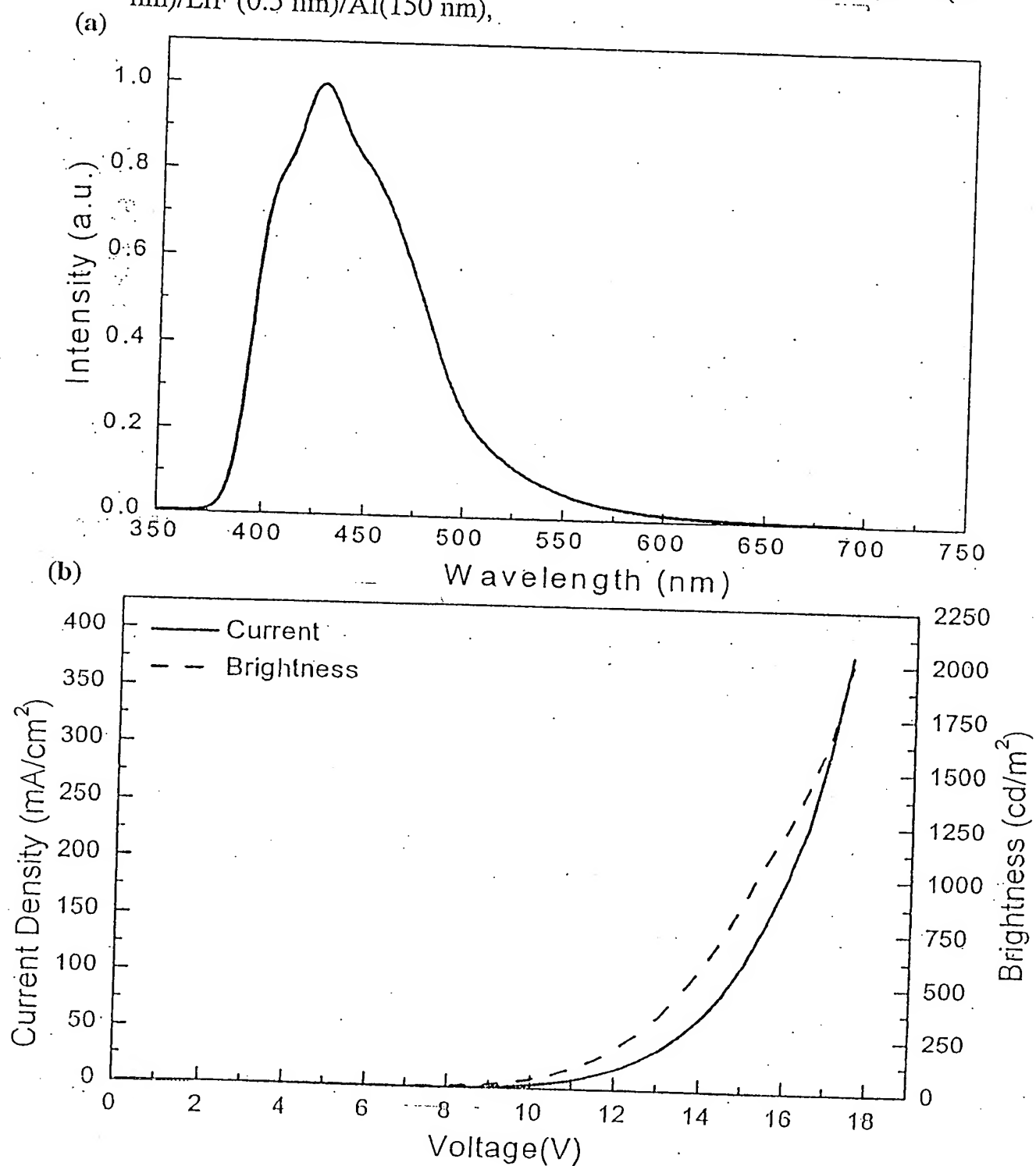


FIG. 9

Device : ITO/PEDT:PSS (30 nm)/ α -NPD (30 nm)/CBP (15 nm)/F-2 (50 nm)/LiF (0.5 nm)/Al(150 nm),

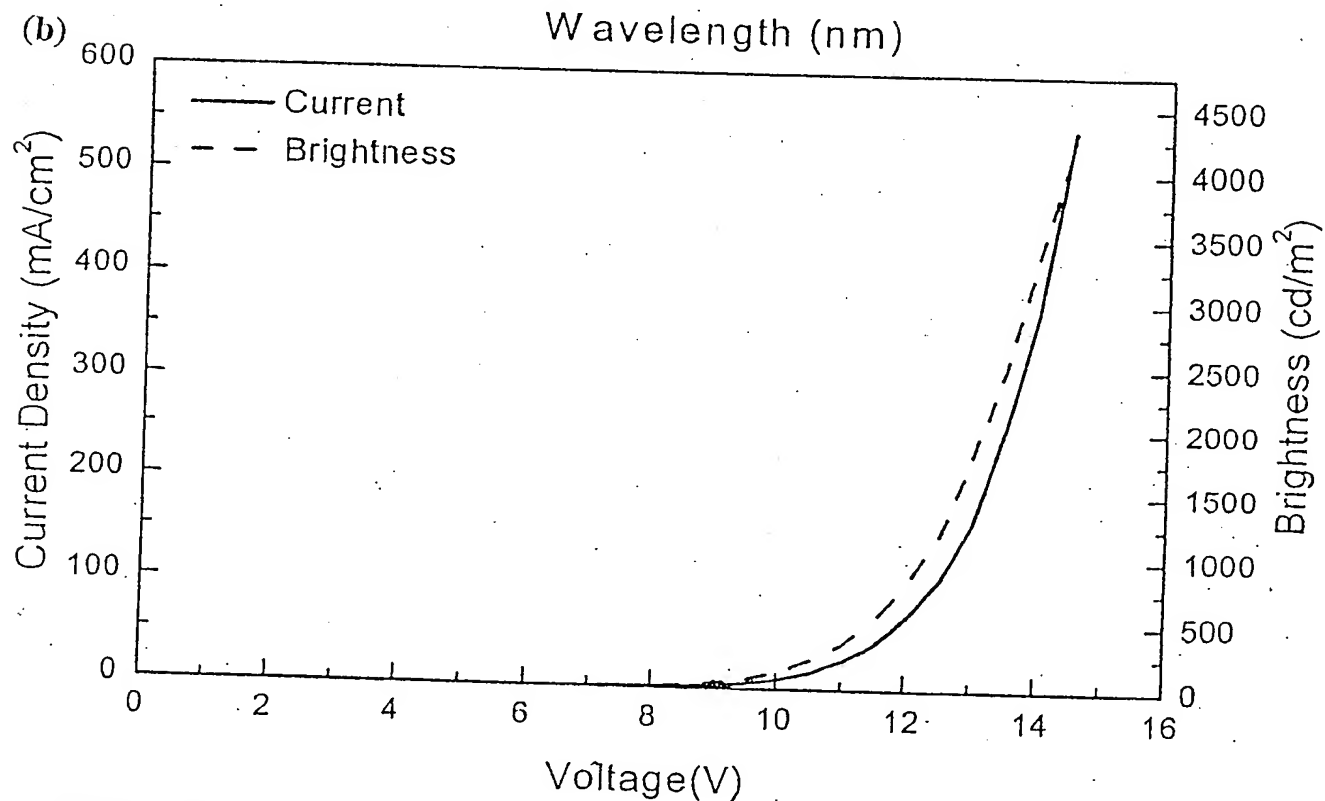
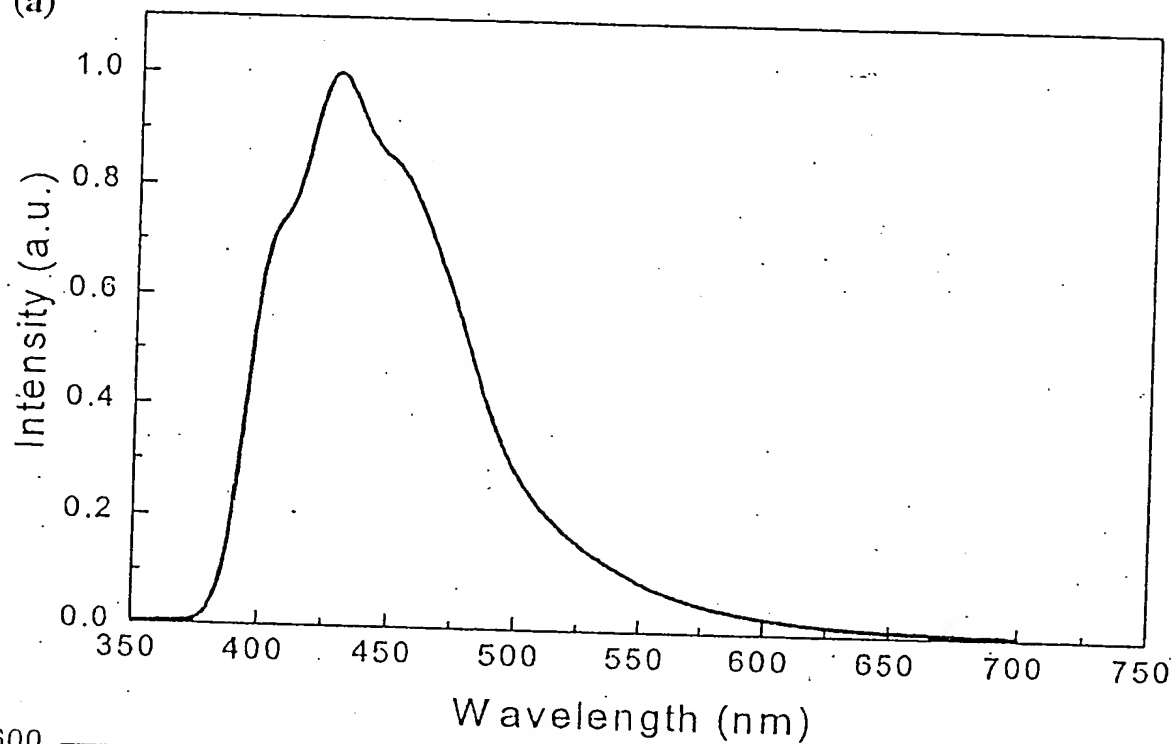


EQE: $\sim 2.3\%$

FIG. 10

Device : ITO/PEDT:PSS (30 nm)/ α -NPD (30 nm)/CBP (15 nm)/F-2 (30 nm)/Alq₃ (20 nm)/LiF (0.5 nm)/Al (150 nm),

(a)



EQE: ~ 2.3%.

FIG. 11

Device 1 : ITO/PEDT:PSS(30 nm)/ α -NPD (45 nm)/F-2:Perylene (1 wt.%, 30 nm)/Alq₃(20 nm)/LiF(0.5 nm)/Al(150 nm),

Device 2 : ITO/PEDT:PSS(30 nm)/ α -NPD (25 nm)/NCB(20 nm)/F-2:Perylene (1 wt.%, 30 nm)/Alq₃(20 nm)/LiF(0.5 nm)/Al(150 nm),

Device 3 : ITO/PEDT:PSS(30 nm)/NCB (45 nm)/F-2:Perylene (1 wt.%, 30 nm)/Alq₃(20 nm)/LiF(0.5 nm)/Al(150 nm),

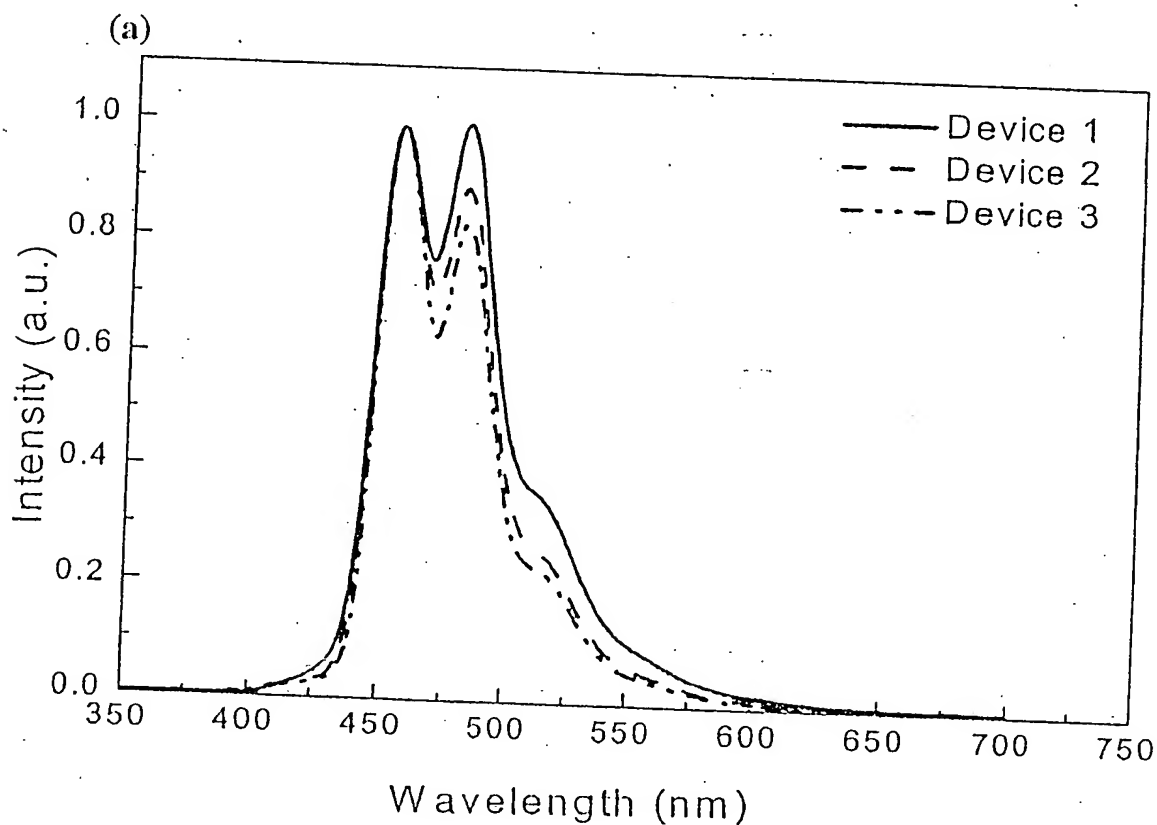
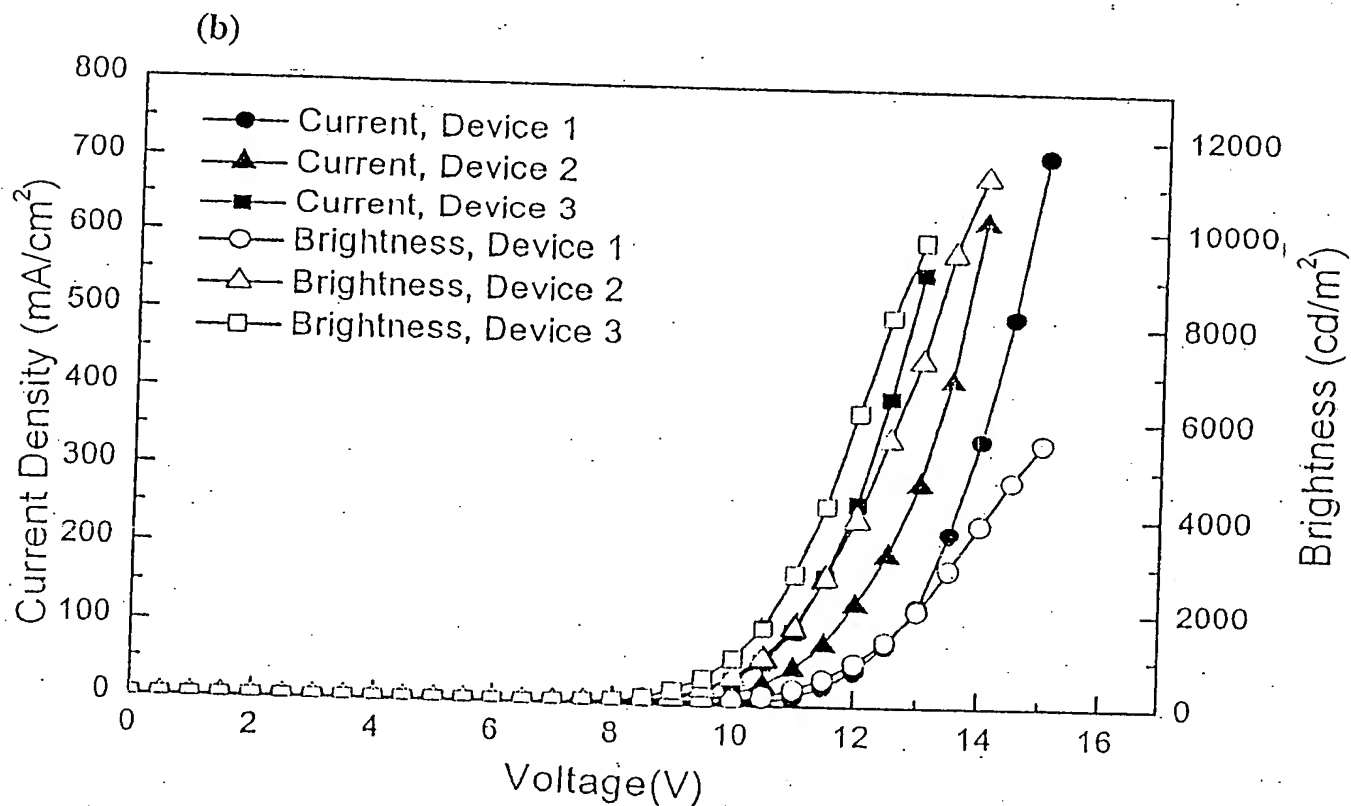


FIG. 12a

Device 1 : ITO/PEDT:PSS(30 nm)/ α -NPD (45 nm)/F-2:Perylene (1 wt.%, 30 nm)/Alq₃(20 nm)/LiF(0.5 nm)/Al(150 nm),
 Device 2 : ITO/PEDT:PSS(30 nm)/ α -NPD (25 nm)/NCB(20 nm)/F-2:Perylene (1 wt.%, 30 nm)/Alq₃(20 nm)/LiF(0.5 nm)/Al(150 nm),
 Device 3 : ITO/PEDT:PSS(30 nm)/NCB (45 nm)/F-2:Perylene (1 wt.%, 30 nm)/Alq₃(20 nm)/LiF(0.5 nm)/Al(150 nm),



EQE:

Device 1: ~ 3% ; Device 2: ~ 4% ; Device 3: ~ 4% .

FIG. 12b

Device 1: ITO/PEDT:PSS (30 nm)/ α -NPD (45 nm)/F-2:Perylene (1 wt.%, 25 nm)/F-2 (25 nm)/LiF (0.5 nm)/Al (150 nm),
Device 2: ITO/PEDT:PSS (30 nm)/ α -NPD (45 nm)/F-2:Perylene (5 wt.%, 25 nm)/F-2 (25 nm)/LiF (0.5 nm)/Al (150 nm),

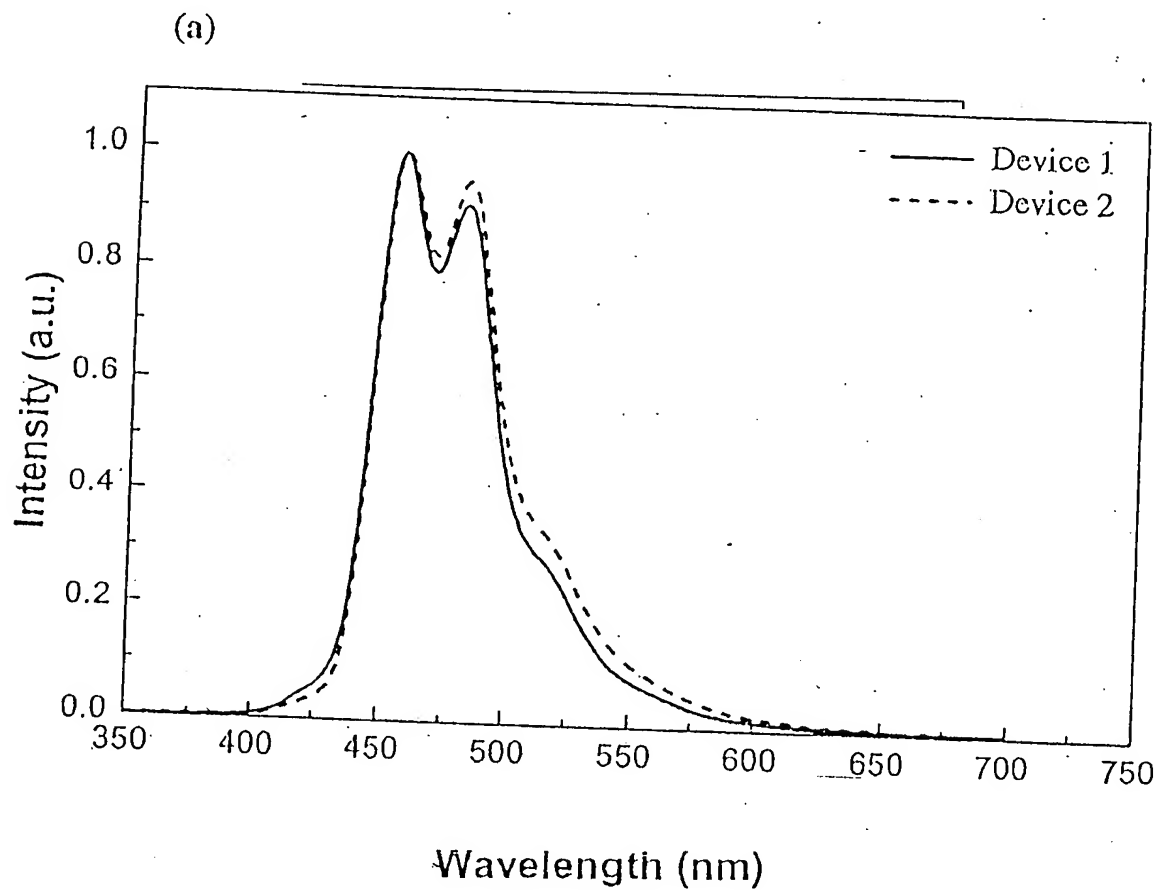
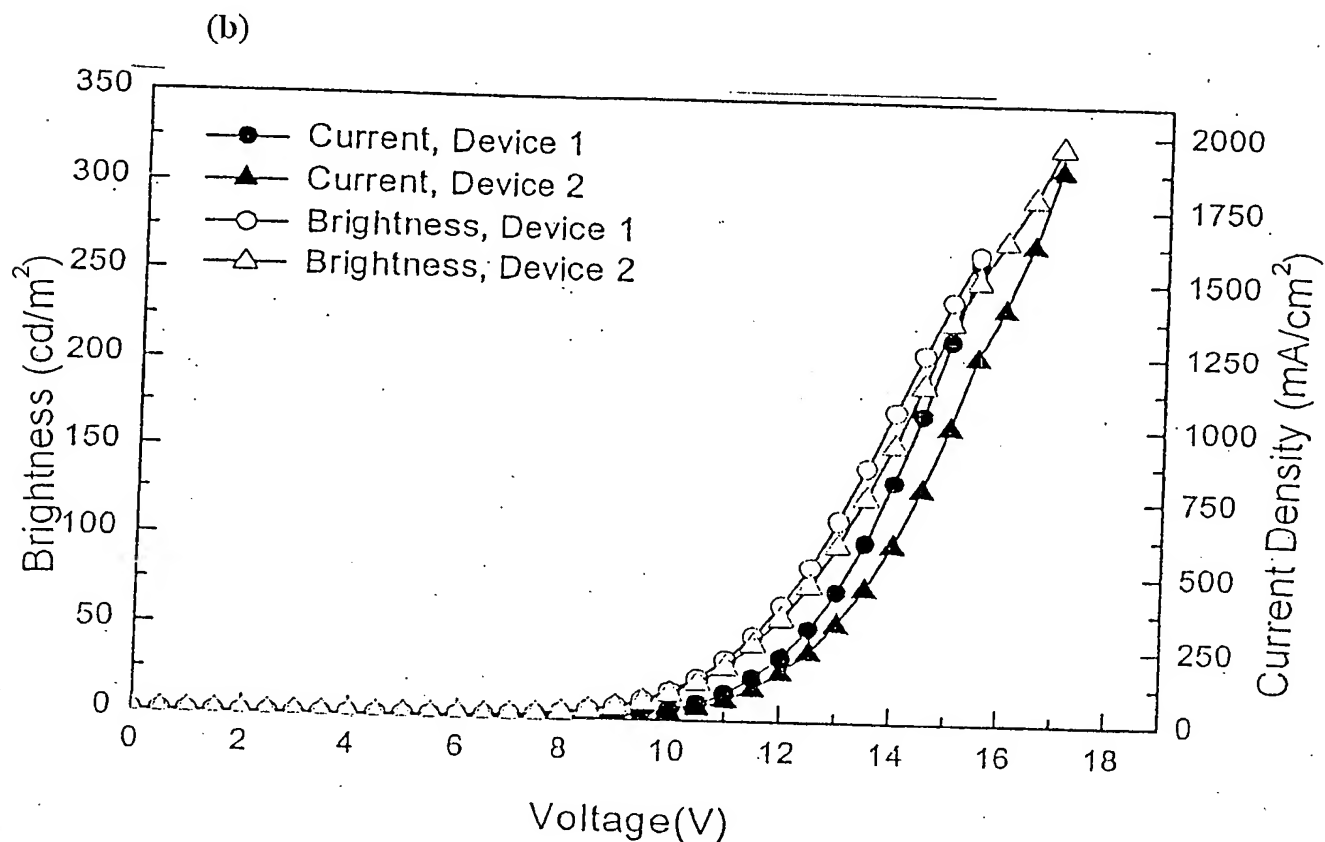


FIG. 13a

Device 1: ITO/PEDT:PSS (30 nm)/ α -NPD (45 nm)/F-2:Perylene (1 wt.%, 25 nm)/F-2 (25 nm)/LiF (0.5 nm)/Al (150 nm),

Device 2: ITO/PEDT:PSS (30 nm)/ α -NPD (45 nm)/F-2:Perylene (5 wt.%, 25 nm)/F-2 (25 nm)/LiF (0.5 nm)/Al (150 nm),



EQE:

Device 1: ~ 2.8% ; Device 2: ~ 3.2 %.

FIG. 13b

Device : ITO/PEDT:PSS (30 nm)/NCB (45 nm)/F-2:Perylene (1 wt.%, 50 nm)/LiF (0.5 nm)/Al (150 nm)

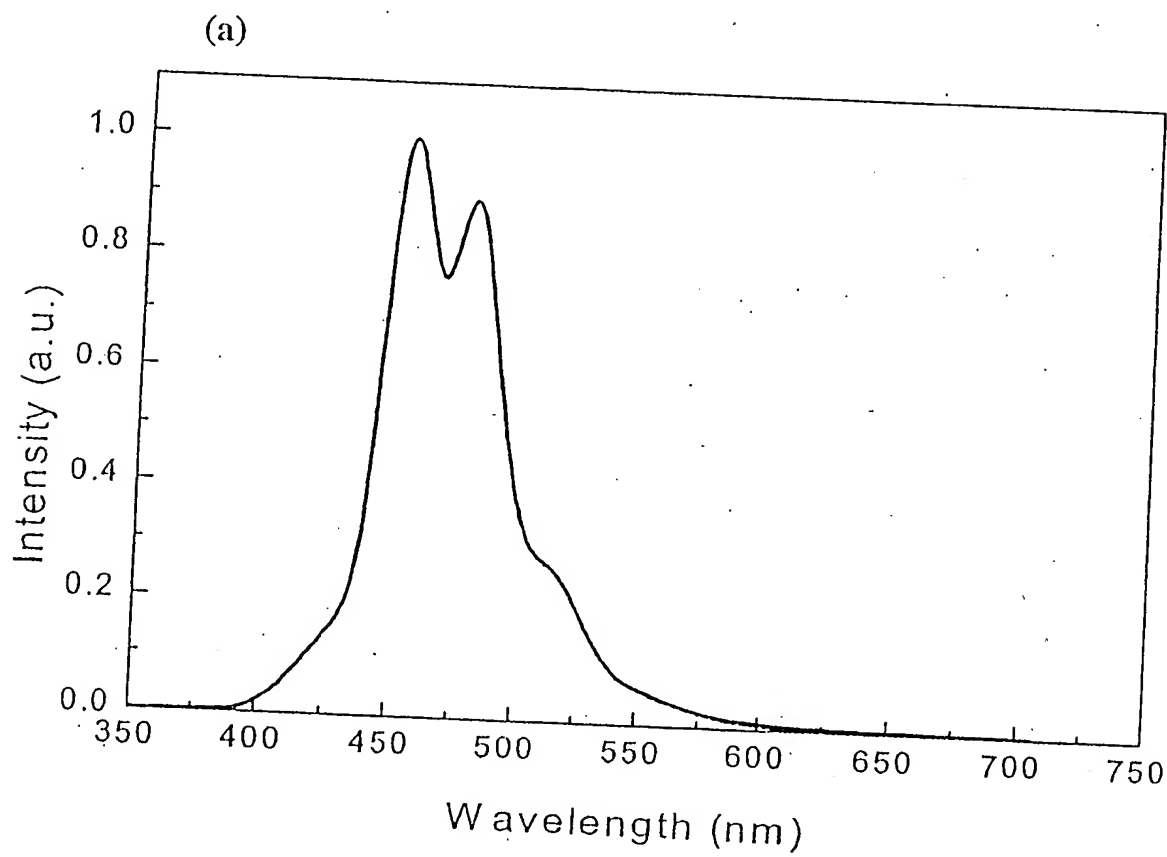
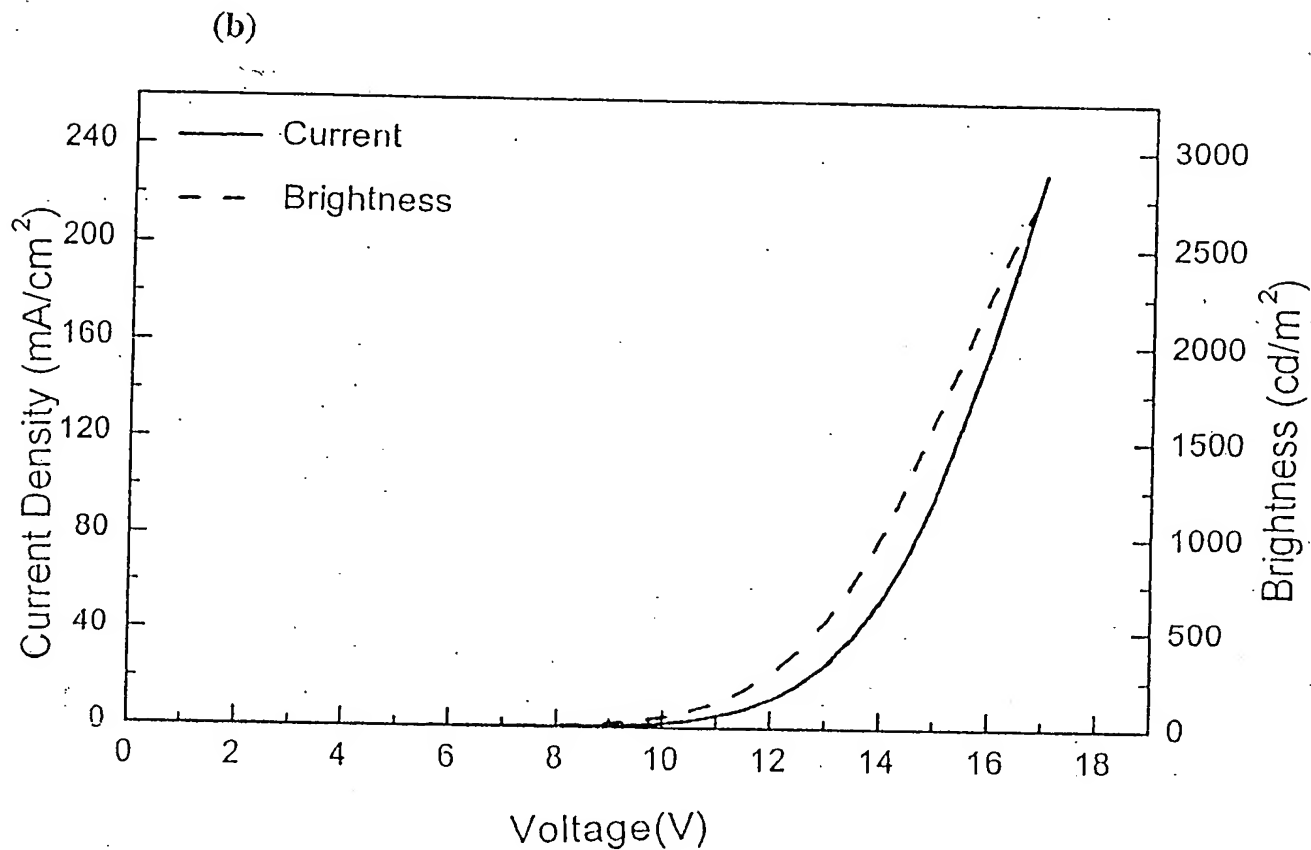


FIG. 14a

Device : ITO/PEDT:PSS (30 nm)/NCB (45 nm)/F-2:Perylene (1 wt.%, 50 nm)/LiF (0.5 nm)/Al (150 nm)



EQE: ~ 2.8%.

FIG. 14b

Device 1: ITO/PEDT:PSS (30 nm)/ α -NPD (25 nm)/NCB (20 nm)/F-2 (30 nm)/Alq₃ (20 nm)/LiF (0.5 nm)/Al (150 nm),

Device 2: ITO/PEDT:PSS (30 nm)/NCB (45 nm)/F-2 (30 nm)/Alq₃ (20 nm)/LiF (0.5 nm)/Al (150 nm),

(a)

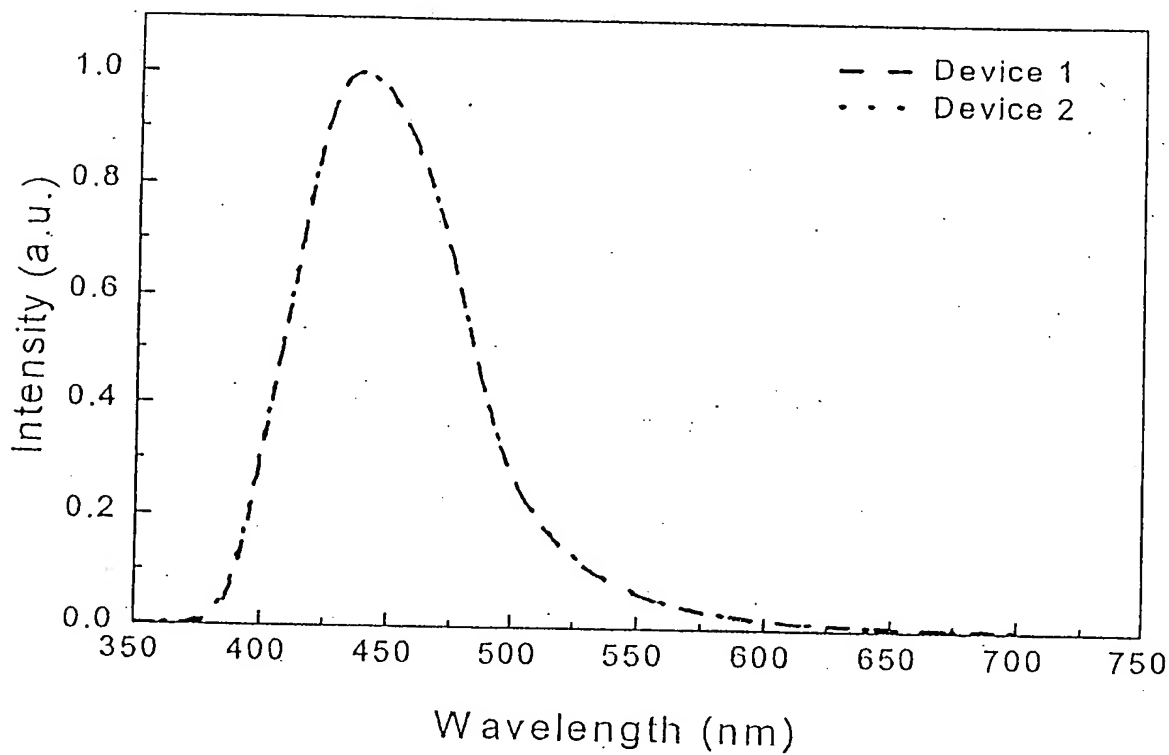
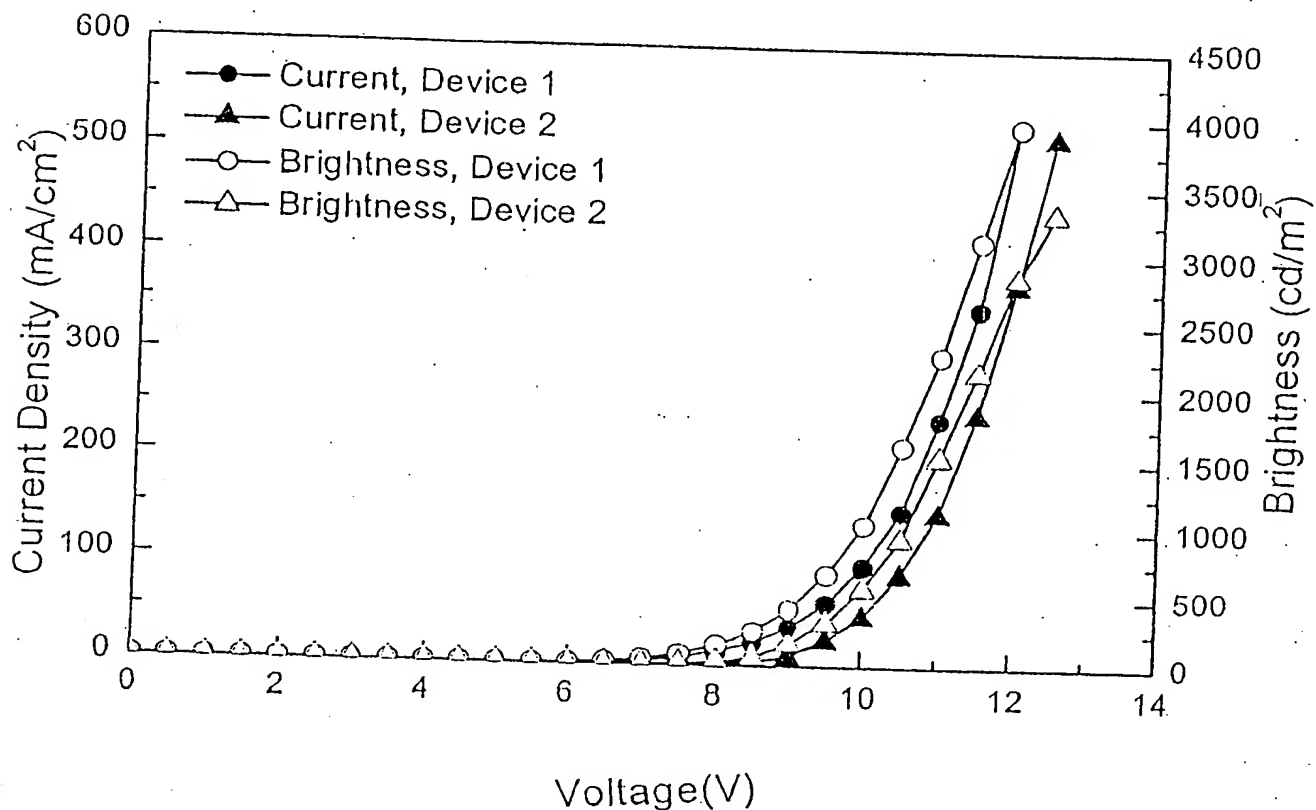


FIG. 15a

Device 1: ITO/PEDT:PSS (30 nm)/ α -NPD (25 nm)/NCB (20 nm)/F-2 (30 nm)/Alq₃ (20 nm)/LiF (0.5 nm)/Al (150 nm),

Device 2: ITO/PEDT:PSS (30 nm)/NCB (45 nm)/F-2 (30 nm)/Alq₃ (20 nm)/LiF (0.5 nm)/Al (150 nm),

(b)



EQE:

Device 1: ~ 2% ; Device 2: ~ 2%.

FIG. 15b